

## PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

Improvements in the Manufacture of Felts for use in the  
Manufacture of Paper and other products

5 We, THOMAS HARDMAN & SONS LIMITED, a British Company, and JOHN FORD, a British Subject, both of Fernhill Mills, Bury, Lancashire, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

10 In the specifications of our Patents Nos. 801,439 and 801,440 we have described improved processes of manufacture of felts suitable for use in the manufacture of paper, including pulp and board, and asbestos cement sheets, such processes including the steps of  
15 weaving a fabric of a suitable textile fibrous material, teasing a nap upon one or both surfaces of the fabric, and subjecting the raised fibres on the face or faces of the fabric to a needling operation so that they  
20 are secured to the fabric at a number of points along their length.

25 With the object of providing improvements in the aforesaid process, for the purpose of achieving substantially increased absorbency and resilience, and enhanced durability of the product, it is now proposed by the present invention to construct multi-layer felts in which nap-composing fibres which have been raised by teasing or otherwise on the sur-  
30 faces of the constituent layers, each of which layers is basically an independently woven fabric assembled in juxtaposition surface to surface with the other layer or layers, are subjected to a needling operation performed  
35 upon the composite assembly, so that said nap-composing fibres are secured both to the layer from which they have been raised and to the layers assembled therewith at a number of points along their length.

40 A composite multi-layer felt so constructed may be expected to enjoy not only the sum of the qualities which would have been possessed by an equal number of individual single layer felts as produced in accordance with our

afore-mentioned prior patents, but the addi- 45 tional source of strength and wearing qualities due to the inter-connection of the constituent layer fabrics by elements, i.e. the raised nap-forming fibres, which are themselves integral portions of the layers. A further advantage 50 arises from the cushion-like mass of nap fibre which exists between the assembled layers of the composite felt, and which forms a shock-resistant component which is effective to enhance the efficiency of the felt in the most 55 arduous operating conditions. Other advantages possessed by the improved composite felt are evident from the following description of the manner of its manufacture.

60 Various alternative methods of carrying the invention into effect are hereinafter described with reference to the accompanying drawings which are diagrams showing different methods of assembling the component layers of the im- 65 proved felt.

70 The felt shown in Fig. 1 is fashioned from two independent lengths of woven fabric, each such length constituting a layer of the composite felt. The outer layer is indicated by the reference letter A and the inner layer by the 75 letter B. Such separate layer fabrics may be identical in all respects, or they may be of different materials and/or of different weaving characteristics so as to be respectively de- 80 signed to fulfil different functions in the specification of the composite felt. Each of the layers A and B is prepared by teasing a nap upon one or both of the faces of the fabrics, and its ends are pieced by butt jointing (as shown) or by splicing in any conventional 85 manner. The two endless fabrics so prepared are assembled one within the other, the relative arrangement being such that the piecings are staggered to avoid undue thickness at any given point. In this connection it may be noted that the splicings necessary for joining the ends of a layer of composite felt made in accordance with this invention do not require to be so

[Price 4s. 6d.]

extensive as has hitherto been customary in endless felt production, owing to the fact that the spliced portion of one layer is needled to a continuous part of the other layer the inherent strength of which is utilised to reinforce the joint.

After assembly of the layers as aforesaid, they are together subjected to a needling operation, the needles passing through both layers, in conventional manner alternately form opposite faces. The effect of this operation is to cause the fibres which form the naps on the outer faces and on the contacting faces of the layers to be drawn through the composite structure at many intermediate points in their length, so that the layers are "stitched" together or inter-connected substantially over their entire surfaces by fibres which are themselves integral elements of the component fabrics.

Fig. 2 depicts an alternative method, in which each constituent layer consists of an endless woven fabric which is teased on one or both surfaces to raise a nap. One layer C is arranged within the other D and the assembly is then needled to form the composite structure.

In the method illustrated in Fig. 3 a continuous length of open-ended fabric is looped upon itself, after teasing, so that each loop forms a ply, e.g. at E and F, and the leading and trailing edges e and f are so arranged that when the whole is needled they lie in abutting relationship except for the fact that they are separated by the intervening ply at G. The needling operation combines the looped fabric into a composite multi-ply structure, without variation in thickness of the same.

A further method of manufacturing a composite felt in accordance with the invention is shown in Fig. 4. A conventionally woven and raised felt which may be endless, or butt-joined as shown, is combined with an additional layer fabric by a needling operation, such layer J being of a very thin finely woven material which has been subjected to an abnormally heavy teasing operation. If desired, more than one such additional layer may be incorporated. The layer constitutes the working surface of the felt, upon which the paper pulp or the like is supported, and it will be evident that this method lends itself to the production of felts combining fine non-marking surface characteristics with a basic structure of high tensile strength and durability.

Fig. 5 illustrates still another method in accordance with the invention. In this case an endless woven fabric of double the width of the desired felt is raised, and teased on both sides after which it is folded selvedge to selvedge to make a double-ply endless felt of the required width, the two plies being then needled together into a composite structure. Said composite structure is then stretched, and both

edges are trimmed to the required width and in the course of such trimming operation the fold in the original fabric is removed. By these means it is possible to produce a composite felt of which both plies are necessarily identical in all respects, being parts of the same fabric.

In performing any of the methods hereinbefore described, it may be found advantageous, when the layers or plies have been assembled preparatory to the final needling operation, to attach the layers or plies to each other by loose stitching, in order to prevent creeping of one layer or ply in relation to the other and to facilitate the passage of the assembly through the needling machine.

#### WHAT WE CLAIM IS:—

1. A method of manufacture of a multi-ply felt for use in the manufacture of paper and analogous products, which consists in teasing or other wise raising the surface of each of a plurality of woven fabrics to form a nap on one or both surfaces thereof, assembling said teased fabrics in juxtaposition surface to surface, and subjecting the composite assembly to a needling operation so that the nap-composing fibres are secured at points intermediate of their length to the layer from which they have been raised and to the layers assembled therewith.

2. The method claimed in Claim 1, using independent lengths of independently woven fabric for the respective plies, wherein the respective layers are pieced by butt-joint or splicing, and wherein the piecings are staggered in the assembled composite felt.

3. The method claimed in Claim 1, wherein the needling operation is performed alternately from opposite faces of the assembled plies.

4. The method claimed in Claim 1, wherein the composite plies are woven as endless fabrics which, on assembly are arranged one within the other.

5. The method claimed in Claim 1, wherein a continuous length of open-ended fabric is, after teasing, looped upon itself so that each loop forms a ply, the leading and trailing edges being arranged so that when the whole is needled they lie in such relationship that the composite structure is of uniform thickness at the seam.

6. The method claimed in Claim 1 and Claim 2 or Claim 3, wherein the working surface ply is composed of a thin finely woven material which has been heavily teased, as and for the purpose stated in Claim 1.

7. The method claimed in Claim 1, wherein an endless woven fabric is teased on both sides and folded selvedge to selvedge, the folded plies being then needled together and the folded edges subsequently cut off.

8. A felt for use in the manufacture of paper or analogous products, made by the

method claimed in any of the preceding claims.

9. A felt made by the method claimed in Claim 2 or Claim 4, wherein the component layers are fabrics of different materials and/or different weaving characteristics, appropriate

to the respective functions of said layers in the composite felt.

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# PROVISIONAL SPECIFICATION

## Improvements in the Manufacture of Felts for use in the Manufacture of Paper and other products

- 10 We, THOMAS HARDMAN & SONS LIMITED, a British Company, and JOHN FORD, a British Subject, both of Fernhill Mills, Bury, Lancashire, do hereby declare this invention to be described in the following statement:—

- 15 In the specifications of our Patents Nos. 801,439 and 801,440 we have described improved processes of manufacture of felts suitable for use in the manufacture of paper, including pulp and board, and asbestos cement sheets, such processes including the steps of  
20 weaving a fabric of a suitable textile fibrous material, teasing a nap upon one or both surfaces of the fabric, and subjecting the raised fibres on the face or faces of the fabric to a needling operation so that they are secured  
25 to the fabric at a number of points along their length.

- With the object of providing improvements in the aforesaid processes, for the purpose of achieving substantially increased strength and enhanced durability of the product, it is now  
30 proposed by the present invention to construct multi-layer felts in which nap-composing fibres which have been raised by teasing or otherwise on the surfaces of the constituent layers, each of which layers is basically an independently woven fabric assembled in juxtaposition  
35 with the other layer or layers, are subjected to a needling operation performed upon the composite assembly, so that said nap-composing fibres are secured both to the layer from which they have been raised and to the layers assembled therewith at a number of points along their length.

- A composite multi-layer felt so constructed  
45 may be expected to enjoy not only the sum of the qualities which would have been possessed by an equal number of individual single layer felts are produced in accordance with our aforementioned prior patents, but the  
50 additional source of strength and wearing qualities due to the inter-connection of the constituent layer fabrics by elements, i.e. the raised nap-forming fibres, which are themselves integral portions of the layers. A further  
55 advantage arises from the cushion-like mass of nap fibre which exists between the assembled layers of the composite felt, and which forms

a shock-resistant component which is effective to enhance the durability of the felt in the most arduous operating conditions. Other advantages possessed by the improved composite felt are evident from the following description of the manner of its manufacture.

One method of carrying the invention into effect utilises independent lengths of woven fabric, one length of each layer in the proposed composite felt. Such separate layer fabrics may be identical in all respects, or they may be of different materials and/or weaving characteristics, so that the individual constituent layers may fulfil different functions in the specification of the composite felt. Each layer fabric is prepared for use in accordance with the invention by teasing a nap upon one or both of its faces, whereafter the layer fabrics are assembled in juxtaposition, one above the other, and the assemblage is subjected to a needling operation, preferably performed in conventional manner alternately from opposite faces. If desired, the individual layer fabrics may be batched on mandrels or rollers which are mounted one above the other in a creel, the fabrics from the several batches being drawn off for passage in sand-  
85 wich formation through the needling machine.

In an alternative method the constituent layers are each woven as endless fabrics which, after being teased, are arranged one within another before the needling operation.

In another method a continuous length of open-ended fabric may be looped upon itself, after teasing, so that each loop form a ply, and the leading and trailing edges being so arranged that when the whole is needled they abut to complete an integral endless composite felt, without variation in thickness at the seam.

According to still another method of manufacturing a composite felt in accordance with the invention, we may take a conventionally woven and raised felt, endless or otherwise, and combine it with one or more additional layer fabrics by a needling operation, each of such additional layers being of a very thin finely woven material which has been subjected to an abnormally heavy teasing opera-  
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tion. In this way fine non-marking cover layers may be combined with a basic fabric of high tensile strength and durability.

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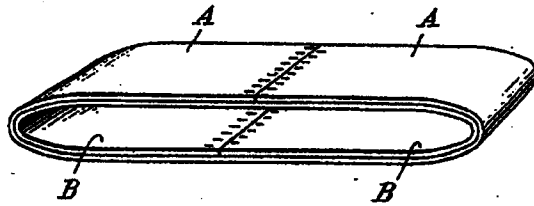
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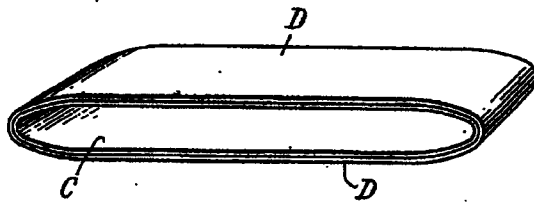
COMPLETE SPECIFICATION

1 SHEET

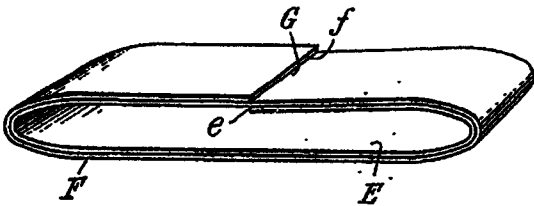
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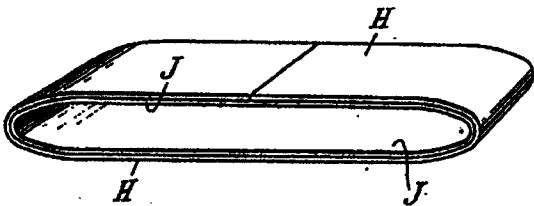
*Fig. 1.*



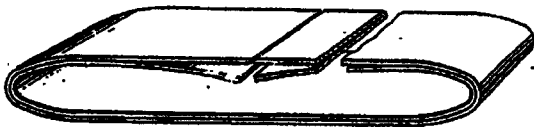
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



*Fig. 5.*